REMARKS

The Section numbers below refer to the numbers used in outstanding Office Action.

2. Claims 1-8, 15 and 21 have been amended, claims 9-14, 16, 18 and 28-38 have been canceled and claims 39-42 have been added. Claims 1-8, 15, 17, 19-27 and 38-42 are now pending.

4. Claims 1-8, 12-1 3 and 15-20 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Lillis et al. (US 20030215680) ("**Lillis**") in view of **Goebel** (US Patent 6,960,404).

5. With regard to claim 1, **Lillis** is said to discloses a hydrogen gas generating system, a membrane electrode assembly including an anode, a cathode, an ionically conductive membrane, and electrical connections.

6. Applicants note with appreciation that **Lillis** has been held to not disclose a non-circulating fuel transport system using capillary action.

7. **Goebel** is said to teach wicking strands that transport water by capillary action for a fuel cell (col. 2, lines 48-67). The Examiner states it would have been obvious to modify **Lillis** with **Goebel**'s fuel transport system to communicate liquid water to maintain adequate hydration of the Proton Exchange Module or PEM.

Applicants respectfully traverse this rejection. **Goebel** teaches a cooling water/vapor transport system rather than a fuel transport system. There would be no motivation to use **Goebel**'s cooling water/vapor system for cooling the cathode in a fuel cell to modify the **Lillis** membrane assembly in the **Lillis** gas generating system because such systems do not require such water/vapor cooling systems. It is only with the benefit of knowing Applicant's techniques, such as using capillary action for the transport of a water/fuel mixture to the anode of a gas generating membrane assembly, that might suggest that the concept of the use of capillary action in **Goebel** for transport of water/vapor for cooling a fuel cell might be advantageously used to modify the **Lillis** gas generating membrane assembly for transporting a water/fuel mixture.

Further, **Lillis** specifically teaches a modular system in which, at the heart of the system, a piping network 120 is used to permit hydrogen flow in either direction from or to hydrogen storage module 500 under the control of controller module 600 (see Fig. 1, [0030]). Replacing the piping system of Lillis with a capillary action water/fuel mixture transport would negate the modularity taught by **Lillis**. For example, even if Lillis was modified to use a capillary action water/fuel mixture transport for the fuel cell 300, the same capillary transport could not be used to refill the hydrogen storage module 500 with the output of equalizer 200 (see Fig.s 1, 10, 11). A modification as proposed by the Examiner would go against the primary teachings of **Lillis**, that is, **Lillis** can clearly be seen to be teaching against the use of non-modular systems.

Further, **Goebel** teaches the use a series of open gas flow channels 74 each separated by a series of columns 76 (see Fig. 2, col. 4, lines 10-17). In an alternate embodiment, **Goebel** teaches a fluid distribution means 168 in which a porous solid layer 170 is used as the wicking medium to permit gas and liquid to flow through a single layer. Distinct channels to separate gas and liquid within the wicking material may be formed by treating certain regions to be hydrophilic and others to be hydrophobic. Path ways of gas and liquid may be delineated from one another by different pore sizes, one facilitating liquid wicking and the other gas flow. (see Fig. 6, col. 11, lines 40-64). That is, **Goebel** teaches the use of parallel wicking paths for liquid and gas distribution across the surface of the cathode rather than the serial liquid/gas portions or paths taught by the present application.

It is important to note that the use of parallel path ways as taught by **Goebel** permits gases released from the water/fuel mixture, such as fuel vapor, to be vented along with the released gases. The use of serial paths as taught in the present application can prevent the loss of fuel vapor along a wicking path when the second path in the series acts as a barrier to the transport of the water/fuel mixture toward the vent. This approach advantageously permits, for example, that the water/fuel vapors not used by the anode can be captured for reuse.

In particular, nothing in **Lillis** or **Goebel**, taken individually or combined, renders obvious a non-circulating transport layer for transferring a water/fuel mixture by capillary action through a first portion of the layer from a source of the water/fuel mixture to the anode to generate hydrogen gas and through a second portion of the layer from the first portion to a vent to transport gases released by consumption of the water/fuel mixture away from the anode, the second portion of the layer

acting as a barrier to the transport of the water/fuel mixture to the vent as claimed in claim 1 as now amended.

8. With regard to claims 2-7, **Goebel** is said to teach the specifics characteristics of the claimed fuel transport system, including a first and second portion that are hydrophilic and hydrophobic, wherein hydrophilic portion has smaller pore size and higher capillary force. As noted above, **Goebel** teaches the use of parallel gas/liquid wicking paths or regions.

Claim 2 has been amended for consistency with claim 1 as amended in order to avoid any potential ambiguity resulting from a lack of proper antecedent basis and not for patentability. Nothing in **Lillis** or **Goebel**, taken individually or combined, renders obvious a non-circulating transport layer as claimed in claim 2 in which the first portion is in contact with the water/fuel mixture and the second portion is in contact with the first portion for collecting gases therefrom.

Claims 3 and 4 have been amended for consistency with claims 1 and 2 in order to avoid any potential ambiguity resulting from a lack of proper antecedent basis and not for patentability. Nothing in **Lillis** or **Goebel**, taken individually or combined, renders obvious a non-circulating transport layer as claimed in claims 3 or 4 wherein areas of said first and second portions are interspersed or interlaced along the contact between the first and second portions. Nothing in **Lillis** or **Goebel**, taken individually or combined, renders obvious the hydrogen gas generating as claimed in claims 5-7 whereby the second portion acts as the barrier to the transport of the water/fuel mixture to the vent for the released gases.

9. With regard to claims 8, 12, 13 and 15-20, **Lillis** is said to disclose the conventional components in the claims, including replaceable fuel water canister, hydrogen gas storage tank, forward regulator to deliver hydrogen gas, backpressure regulator, vent regulator, electrical connections. Claims 12, 13, 16 and 18 have been canceled. Claim 15 has been amended to avoid any potential lack of proper antecedent basis and not for patentability.

Nothing in **Lillis** discloses or renders obvious the replaceable fuel/water canister pressurized by a compartment receiving the released gases as claimed in claim 8 as now amended.

Nothing in **Lillis** discloses or renders obvious a forward regulator for varying the amount of hydrogen gas provided by the membrane electrode assembly to a source of electrical power to

enhance load following characteristics of the source for changes in the amount of electrical power required by a load as claimed in claim 15 as now amended.

Nothing in **Lillis** discloses or renders obvious the claimed system wherein

- the forward regulator opens to provide additional hydrogen gas to the source of electrical power when the operating efficiency of the source is reduced as claimed in claim 17 as now amended, or
- wherein electrical power, produced by the load during regeneration, is applied to the membrane electrode assembly while the forward regulator is closed to store excess hydrogen being produced as claimed in claim 19, or
- the pressure of a backpressure regulator is referenced to a vent regulator to maintain the cathode pressure above the anode pressure as claimed in claim 20.

10. Claims 21-28 stand rejected under 35 U.S.C. 103(a) as being unpatentable over **Lillis** in view of **Goebel** and further in view of Pien et al. (**"Pien"**).

Applicant understands this rejection to apply to claims 21-27 because claim 28 is related to a spiral coil for the membrane electrode assembly. Similarly the rejection below in Section 13 of claims 29-38 related to a spiral coil is understood to include claim 28.

11. Applicant's note with appreciation that **Lillis** in view of **Goebel** is held to not specifically disclose a cooling system with cooling ports. As noted in Sect. 7 above, **Goebel** teaches a cooling water/vapor transport system rather than a fuel transport system.

12. **Pien** is said to teach cooling system with cooling ports. The Examiner has said that it would have been obvious to modify **Lillis** in view of **Goebel** with the cooling system and cooling ports of **Pien** in order to distribute cooling fluid and cool the fuel cell. However, **Pien** teaches the use of a distributor plate or additional passages 80, 82, to direct a coolant fluid flow to the membrane assembly 12a which employs membrane 90 sandwiched between carbon electrodes 92 and 94 with platinum catalyst layers 96, 98, in between them. That is, although coolant fluid is conducted to the membrane assembly, there is no teaching or suggestion of a cooling system within the membrane electrode assembly.

Nothing in **Lillis**, **Goebel** or **Pien**, taken singly or combined, renders obvious a cooling system within the membrane electrode assembly for recovering liquid from gases produced by the membrane electrode assembly as claimed in claim 21. Claim 21 has been amended for conformity with the cancellation of claim 12 and not for patentability. Claims 22-27 are dependent on claim 21.

13. Claims 29-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lillis et al. in view of **Goebel** and further in view of Montemayor et al. ("**Montemayor**"). As noted above, this rejection is understood to include claim 28 as well as claims 29-38 which depend on claim 28. Claims 28-38 have been canceled and claims 39-42 have been added.

14. Applicant notes with appreciation that **Lillis** in view of **Goebel** is held to not disclose a spiral-shaped fuel cell.

15. **Montemayor** is said to teach a spiral-shaped fuel cell that is generally cylindrical. It is said that it would have been obvious modify **Lillis** in view of **Goebel** with the **Montemayor** spiral fuel cell design in order to minimize electrical resistance losses. Such a combination, if made, would not result in the self contained hydrogen gas generating cylinder having a transport layer wicking a water/fuel mixture from a first end of the assembly along a first path to the anode layer and transporting released gases along a second path, in series with the first path, from the anode layer to a second end of the assembly

16. With regard to claim 29-38, **Lillis** in view **Goebel** is discloses conventional features such as inlet, outlets, backpressure regulators, hydrogen gas storage tank, fuel water canisters and supply lines to fuel water canisters and that **Montemayor** discloses a hollow central core in the spiral-shaped fuel cell. Claims 29-38 have been canceled.

With regard to newly added claim 39, nothing in **Lillis**, **Goebel** or **Montemayor** taken alone or in combination, discloses or renders obvious a self contained hydrogen gas generating cylinder including a spiral membrane electrode assembly, in a cylindrical housing, including the transport layer wicking a water/fuel mixture from a first end of the assembly along a first path to the anode layer and transporting released gases along a second path in series with the first path from the anode

layer to a second end of the assembly, nor fuel or released gases storage compartments in the cylindrical housing as now claimed.

With regard to newly added claims 40-42, nothing in **Lillis**, **Goebel** or **Montemayor** taken alone or in combination, discloses or renders obvious a self contained hydrogen gas generating cylinder including a valving system for releasing hydrogen through one end cap electrode and venting released gases from the other end cap electrode as claimed in newly added claim 40, nor fuel or output diaphragms for pressurizing the water/fuel or hydrogen storage compartments as claimed in newly added claims 41 and 42.

Applicants respectfully request that the Examiner reconsider the rejections of the claims in light of the amendments and arguments presented herein, allow the pending claims and pass this case to issue.

Respectfully Submitted,

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